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H4D DRPZ D348 D507

(56) Documents cited
International Conference Radar 87 (conf.pubn.No.281
London 19-21 Oct '87 p12-16 Description of an
experimental bistatic radar system Soames, T.A.;
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IEE PROC-F Communications Radar and Signal
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pp587-595
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(58) Field of search
UK CL (Edition K) H4D DRPZ
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(54) High PRF bistatic/multistatic radar

(57) The transmitter (55) in a bistatic or multistatic radar system transmits a beam (54) of pulses (57, 59-63) at a sufficiently fast rate that more than one is "visible" to the system receiver at any given time. The receiver includes a phased-array aerial which has a plurality of reception beams having respective outputs. These beams are scanned along the transmitted beams so as to "chase" respective transmitted pulses simultaneously. In order to prevent pulses not being chased by a given beam (e.g. 63) from influencing the output signal corresponding to that beam successive pulses are coded differently and the output signal path corresponding to each beam includes a filter matched to the coding of the particular pulses chased by that beam.

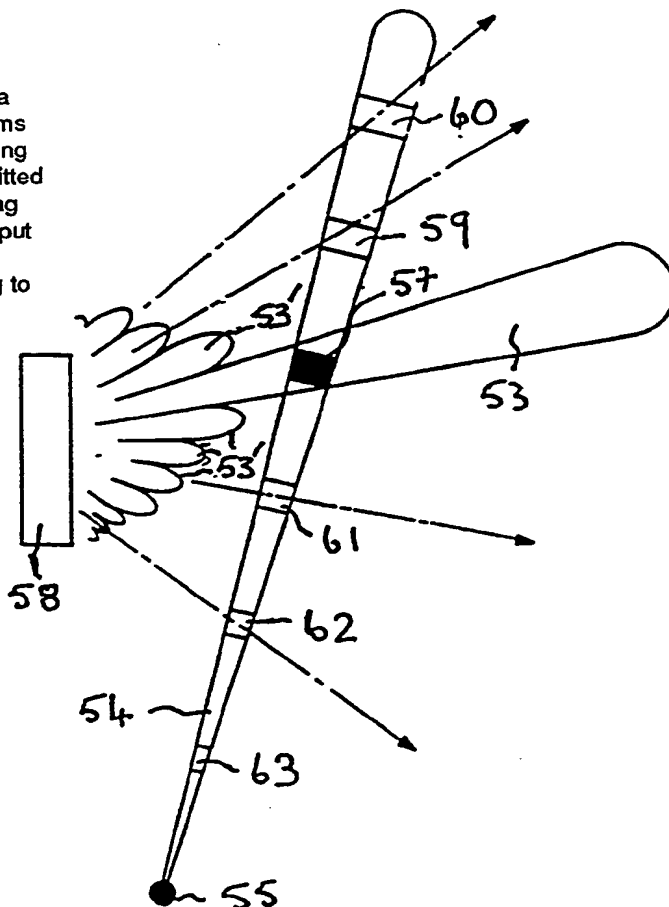


FIG. 2.

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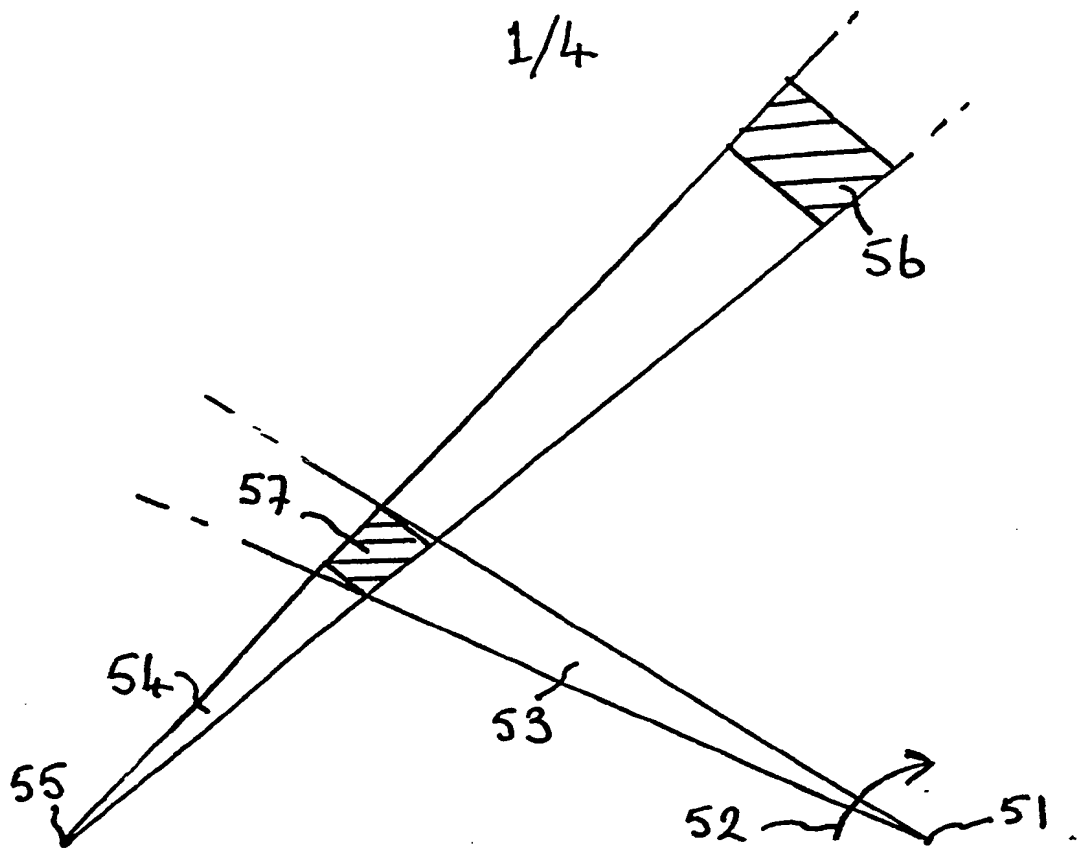


FIG. 1.

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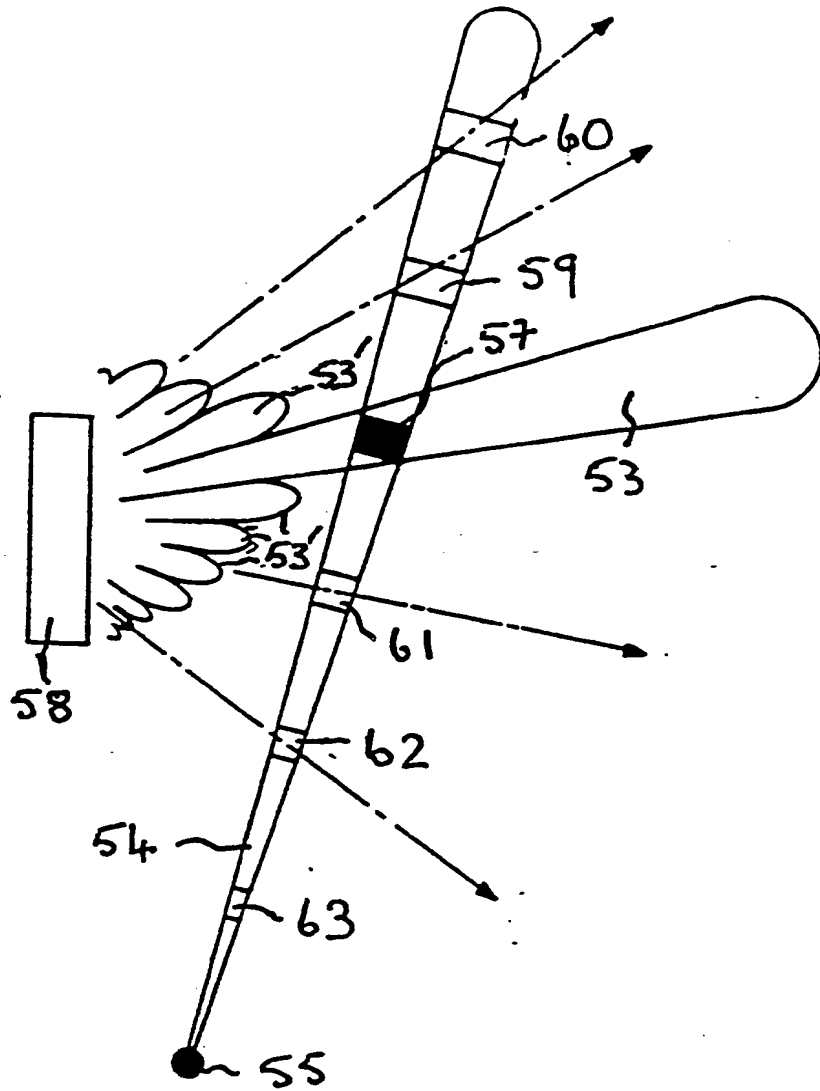


FIG. 2.

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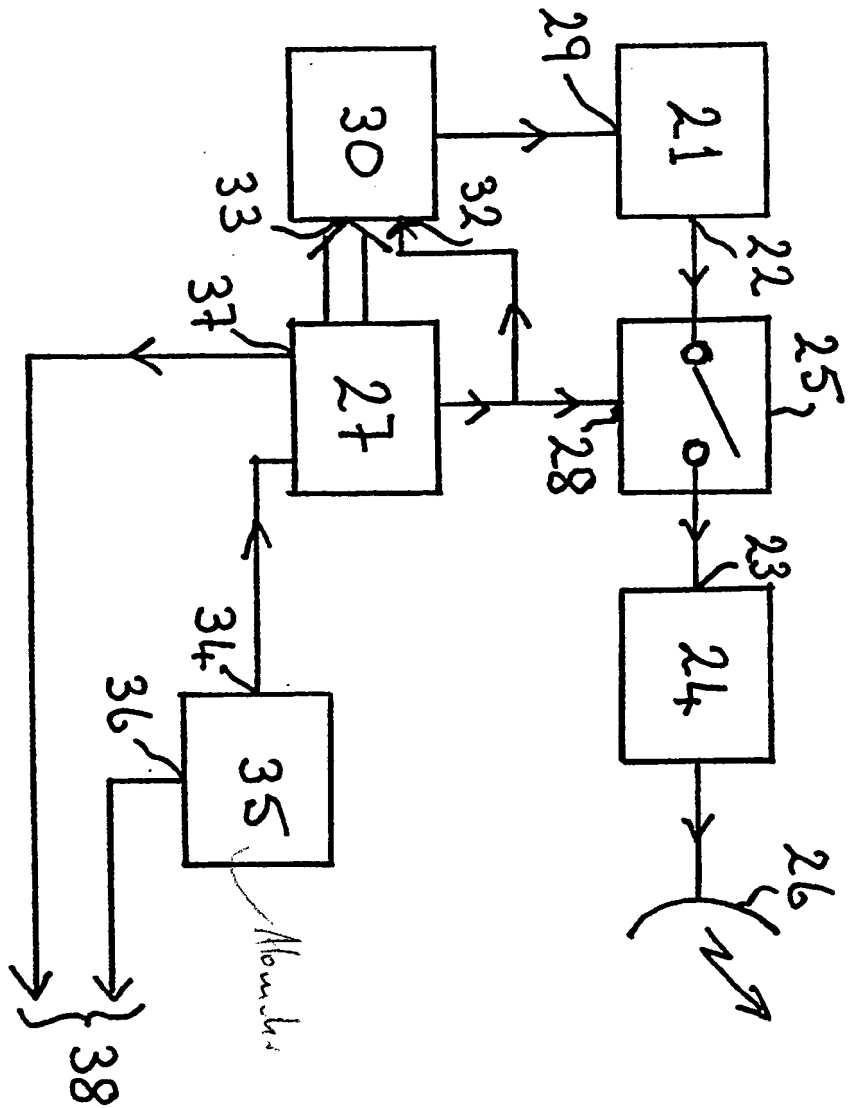
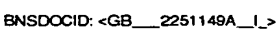


FIG. 3.



DESCRIPTION

HIGH PRF BISTATIC/MULTISTATIC RADAR

5 This invention relates to a radar system which comprises a radar transmitter and a radar receiver in spaced relationship, the transmitter comprising transmitter means for transmitting a beam of pulsed radio energy and the receiver comprising an aerial system for receiving said energy after reflection by a target, the transmitter means being arranged to transmit the pulses of radio
10 energy at rate which is sufficient to result in reflected energy derived from a plurality of said pulses being received by said aerial system simultaneously, said aerial system having a directional characteristic such that a plurality of reception beams, each having a respective output signal path, are defined, and the receiver including scanner means for repeatedly scanning at
15 least two of said reception beams along the transmitted beam at the same time so as to track reflected energy derived from respective ones of the transmitted pulses, said respective ones of the transmitted pulses being, for each scan, pulses which are
20 transmitted in direct succession by the transmitter.

Radar systems in which a transmitter and one or more receivers are situated in spaced-apart relationship (by a distance which is significant compared to likely target ranges) - so-called bistatic or multistatic radar systems - are well-known. Pulse-type such
25 systems usually employ a technique called "pulse-chasing"; see, for example, the paper "The Geometry of Bistatic Radar Systems" by M.C. Jackson in Proc. IEE, part F, vol. 133 no. 7 (Dec. 1985). As depicted diagrammatically in Figure 1 of the accompanying drawings the or each receiver 51 repeatedly scans (denoted by arrow 52) a
30 reception beam 53 along the beam 54 of pulses from the transmitter 55 so as to track energy derived from respective ones of these pulses, resulting in the reception beam at all times ideally encompassing a volume of space from which echoes are potentially
35 arriving. The instantaneous portion of the reception beam 53 shown

in the Figure is that required to receive reflected energy from a pulse shown at 56, the distance between the aerial of the receiver 51 and the volume 57 of space at which the beams 53 and 54 intersect being equal to the distance between the volume 57 and the present position of the pulse 56.

5 It is sometimes desirable in a pulse-type radar system to choose a comparatively high repetition frequency for the transmitted pulses, e.g. because this allows better Doppler discrimination (higher "blind speeds") to be obtained. At first sight this poses no particular problem in a bistatic/multistatic radar system, even if the pulse repetition frequency (PRF) is
10 sufficiently high that energy from at least two pulses has to be tracked by the receiver simultaneously; all that is required is that the receiver aerial system has an independent reception beam corresponding to each pulse the energy from which has to be tracked
15 simultaneously, together with appropriate processing circuitry for the output signals of the various beams. However in practice problems arise due to the inevitable substantial width of the reception beams, the side-lobe responses of which may be, for example, typically only 30dB down with respect to the main beam in
20 an aerial system of the phased-array type. An example of such a situation is illustrated in Figure 2 of the drawings, in which corresponding items have been given the same references as their counterparts in Figure 1. A phased array aerial system at the radar receiver is denoted by a rectangle 58 and has a directional characteristic such that a reception beam 53 is defined. However
25 the situation illustrated in Figure 2 is more realistic than that shown in Figure 1 in that the reception beam is depicted as having sidelobes 53'. The volume of space at which the transmitter and reception beams 54 and 53 theoretically intersect is denoted, as in
30 Figure 1, by reference numeral 57, this being the volume of space from which reflected energy (if any) derived from a particular pulse transmitted by transmitter 55 is expected to come at the instant corresponding to the situation illustrated in the Figure. An assumption inherent in Figure 2 is that the output PRF of
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transmitter 55 is sufficiently high that, simultaneously with reflected energy derived from a particular pulse being expected to come from the volume of space 57, reflected energy derived from two preceding transmitted pulses is expected to come from the volumes of space 59 and 60 respectively, and reflected energy derived from three succeeding transmitted pulses is expected to come from the volumes of space 61, 62 and 63 respectively. (At least some of the volumes 59-63 will be in the course of being tracked by other reception beams, which are not indicated in order to avoid over-complicating the drawing). As shown in Figure 2, the volumes of space 59, 60, 61 and 62 lie in directions relative to the array 58 in which also lie substantial sidelobes 53' of the main reception beam 53, which means that a substantial part of any reflected energy which is derived from the two preceding and two succeeding transmitted pulses will be received by the array 58 simultaneously with reception of energy coming from the volume of space 57, i.e. which is derived from the transmitted pulse actually being tracked. If, for example, the volumes of space 59 and/or 60 and/or 61 and/or 62 contain objects with a large radar cross-section, whereas the volume of space 57 does not, the signals received from the volumes of space 59-62 may actually swamp any signal received by the volume of space 57. Whether or not such swamping occurs it will be evident that the received signals will be ambiguous, indicating merely that a target having a significant radar cross-section is present in one or more of the volumes of space 57, 59, 60, 61 and 62. It is an object of the invention to alleviate this problem.

The invention provides said transmitter means arranged to code each transmitted pulse in such manner that at least any two pulses which are transmitted in direct succession are coded differently from each other, and in that the receiver includes a respective filter in the output signal path of each scanned reception beam for discriminating, on the basis of the coding of the pulses, in favour of signals resulting from the reception of reflected energy currently being tracked by the corresponding reception beam at the

expense at least of any signals resulting from the reception of reflected energy derived from those transmitted pulses which respectively directly precede and directly succeed the transmitted pulse from which the reflected energy currently being tracked is derived.

5 It has now been recognized that signals resulting from the reception of reflected energy other than that which is actually being tracked by a given reception beam can be discriminated against at the receiver if the transmitted pulses are coded in such
10 a way that at least any two pulses which are transmitted in direct succession are coded differently from each other (which means that a tracked pulse will be coded differently to at least the immediately preceding and immediately succeeding pulse, which
15 pulses are the ones most likely to give rise to extraneous signals in the output signal path of a given reception beam). The coding may consist, for example, of merely varying the carrier frequency of the transmitted pulses from pulse to pulse (similar to so-called "frequency hopping"). However more sophisticated coding schemes,
20 such as employing so-called "Barker" codes, can give rise to the additional advantages normally associated with the use of such codes.

The invention also provides a radar receiver for use in such a system, said receiver comprising an aerial system having a
25 directional characteristic such that a plurality of reception beams, each having a respective output signal path, are defined, scanner means for causing at least two of said reception beams to repeatedly scan a given region at the same time but in a staggered manner, and a respective filter included in the output signal path
30 of each scanned reception beam for discriminating in favour of signals coded in a particular way at the expense of signals coded in such a way that they are discriminated in favour of by the filter(s) corresponding to the immediately preceding and immediately succeeding scanned reception beams.

35 An embodiment of the invention will now be described, by way

of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 illustrates pulse-chasing, as previously referred to,

Figure 2 illustrates the effect of reception beam side-lobes when pulse-chasing is employed and a comparatively high PRF is used, as previously referred to,

Figure 3 is a block diagram of the relevant part of the transmitter portion of the embodiment, and

Figure 4 is a block diagram of the relevant part of the receiver portion of the embodiment.

In Figure 3 the transmitter portion of a pulse radar system which comprises a radar transmitter and a radar receiver in spaced relationship comprises an RF oscillator 21 the output 22 of which is coupled to the input 23 of an RF power amplifier 24 via a controllable switch 25. The power amplifier 24 feeds an aerial 26 which in consequence transmits a pulse of radio energy, e.g. in the GHz range, each time switch 25 is closed. Aerial 26 has a directional characteristic so that the transmitted pulses form a beam (c.f. beam 4 in Figure 2). Switch 25 is controlled (alternately opened and closed) by means of a control signal generator 27 via a control signal input 28, the opening and closing being at a sufficiently fast rate that M, where M is greater than one, of the resulting transmitted pulses are "visible" to the aerial system of the radar system receiver at any given time (c.f. Figure 2).

The RF oscillator 21 has a modulation signal input 29 which is fed from the output of a modulation signal generator 30. Generator 30 has an activation signal input 32 which is fed from control signal generator 27 with the same signal that controls the switch 25, so that generator 30 is activated each time switch 25 is closed and is deactivated each time switch 25 is open. Generator 30 has a further input 33 which is also fed from control signal generator 27, the signal fed to input 33 at any given time determining the nature of the modulation signal applied to the oscillator 21.

Δ in direct

Control signal generator 27 is itself clocked from the output 34 of a high-stability master clock signal generator 35, for example of the rubidium type. The output frequency of generator 35 may be, for example, 10MHz. A further output 36 of generator 35 and a further output 37 of generator 27 are coupled to the radar system receiver, via a communication channel denoted by reference numeral 38, for synchronisation purposes.

Control signal generator 27 is arranged, in addition to alternately opening and closing switch 25 in synchronism with respectively deactivating and activating modulation signal generator 30, to apply different codes to the input 33 of generator 30 during successive activation periods of generator 30. Thus generator 30 generates different modulation signals during any two directly successive activation periods, with the result that at least any two successive pulses transmitted by aerial 26 are modulated or coded differently. As a simple example oscillator 21 may be a voltage-controlled oscillator the output frequency of which is determined by the value of a voltage applied to the input 29 and generator 30 may comprise an analogue integrator the input of which is connectable as alternatives to a d.c. source of positive potential and to a d.c. source of equal negative potential by means of a switch controlled to adopt corresponding states by the application of codes A and B respectively to input 33, and to be open circuit when an activation signal is absent from the input 32. In such a case the control signal generator may be arranged to generate the codes A and B alternately, one during each closure period of switch 25, so that the output frequency of oscillator 21 is swept upwards from a frequency f1 to a frequency f2 during every other closure period of switch 25, and is swept downwards from f2 to f1 during each intervening closure period of switch 25, resulting in pulses exhibiting corresponding frequency sweeps being transmitted in succession by aerial 26. Generator 27 may comprise a clocked counter the output of which is provided with appropriate decoders feeding the various outputs shown. As another example oscillator 21 may be constructed so that its output phase is

responsive to the value of a single bit applied to modulation signal input 29, adopting one value when the bit is "0", and the opposite value when the bit is "1". In such a case modulation signal generator 30 may be constructed to generate a succession of e.g. ten bits each time it is activated, the particular set of bits generated each time being determined by the code applied to input 33 so that a different set is generated at least during any two directly successive closure periods of switch 25. To this end generator 30 may comprise, for example, a suitably programmed read-only memory provided with an address counter which is clocked from generator 27 to read out the required set of bits each time generator 30 is activated, the most significant bits of the address being, however, constituted by the code presently applied to the input 33. Each pulse transmitted by aerial 26 will then be phase-modulated by a specific code which changes at least from each pulse to the next. So-called "Barker Codes" may be used for this purpose, the ones actually used preferably being selected on the basis of being poorly correlated with each other.

It will be appreciated that the signals applied by control signal generator 27 to the switch 25 and the modulation signal generator 30 together form a repeating cyclic sequence. Generator 27 is constructed to generate a signal at its output 37 at a specific point in each such sequence in order to enable the operation of the receiver(s) of the radar system to be synchronized with it. If generator 27 comprises a clocked counter with output decoders, as previously mentioned, it may be arranged, for example, to generate a signal at output 37 each time the counter is reset.

In Figure 4 the or each receiver portion of the pulse radar system of which the transmitter portion described with reference to Figure 3 forms part includes an aerial system 1 of the phased-array multiple-beam type. As mentioned previously, the switch 25 of Figure 3 is operated at a sufficiently rapid rate that M (greater than one) of the pulses transmitted by the aerial 26 of Figure 3 are "visible" to the aerial system 1 of Figure 4 at any given time. System 1 in Figure 4 has a directional characteristic such

Digital

that M reception beams are defined at any given time. Each beam has a respective output signal path 42,43 for a complex amplitude, and the beams are repeatedly scanned along the transmitted beam simultaneously but in a staggered manner so as to track reflected energy derived from respective ones of the transmitted pulses, these respective ones being, for each scan, pulses which are transmitted in direct succession by the transmitter, e.g. pulses 60,59,57,61 and 62 respectively in Figure 2. To this end aerial system 1 comprises a linear array 2 of N, for example thirty-two, individual reception elements 3_1-3_N , e.g. microwave horns. Those output signals from the reception elements 3 which are derived from the radio pulses transmitted by the radar system transmitter are amplified and translated to baseband by respective mixer/amplifier arrangements 4_1-4_N . Each arrangement 4 may include a first mixer, fed from a common first local oscillator 5, which translates the output signal of the corresponding element 3 from e.g. the GHz frequency range to e.g. the MHz (IF) range, an IF amplifier and filter, and a second quadrature mixer, fed from a common second local oscillator 6, which translates the IF signal to baseband. The output signals of the oscillators 5 and 6 are each phase-locked to the output signal of a high-stability master clock 7, e.g. an atomic clock of the rubidium type. The output frequency of clock 7 is the same as that of the clock 35 of Figure 3 and these two clocks are phase-locked together via the communication channel 35. The two quadrature output signals I and Q of each mixer/amplifier arrangement 4 are converted to digital form by means of individual analogue-to-digital converters 9_1-9_N and 10_1-10_N respectively, and the results are multiplied by respective calibration factors in respective digital multipliers 11 to compensate for phase and amplitude mismatches which may occur between the various elements 3. After multiplication by the respective calibration factors the digital I and Q signals derived from each element 3 are applied to a corresponding pair of complex amplitude inputs 12_1-12_N and 13_1-13_N respectively of an N-(complex) point Discrete Fourier Transform (DFT) calculating

arrangement 14.

The arrangement 14 has, in normal manner, N pairs of corresponding complex amplitude outputs 15_1-15_N and 16_1-16_N respectively on which appear, for a given orientation of the array 2, simultaneous signals corresponding to respective elementary reception beams which point in respective directions to together form a fan-shaped beam. Thus, for example, a given area could be effectively scanned in azimuth by a single beam by fixedly positioning the array 2 horizontally and then simply switching the various output pairs $15_1, 16_1 - 15_N, 16_N$ to an output in succession. In fact, however, a given area is effectively scanned simultaneously by M beams, the output pairs 15, 16 of the DFT-calculating arrangement 14 being connected to corresponding inputs pairs $17_1-17_N, 18_1-18_N$ of a switching unit 19 whose function is to effect this.

It will be assumed for simplicity and ease of description that the outputs of the M beams each correspond, at any given scan position of the relevant beam, to a respective single elementary reception beam, i.e. to a respective single output pair 15, 16 of the DFT - calculating arrangement 14, although in practice it may be found beneficial to build up a given beam from a plurality of adjacent elementary beams (a "cluster") at least for some scan positions. The switching unit 19 accordingly takes the form of a 2M out of 2N digital multiplexer. Multiplexer 19 is controlled by means of a control signal generator 31 in such manner that it connects its input pairs $17_1, 18_1 - 17_N, 18_N$ in succession and cyclically to its output pair $41_1, 43_1$, and also connects its input pairs $17_1, 18_1 - 17_N, 18_N$ to each of the other output pairs $42_2, 43_2 - 42_M, 43_M$ in a similar way but in such manner than the connection cycle in respect of the output pair $42_1, 43_1$ leads the connection cycle in respect of the output pair $42_2, 43_2$, which in turn leads the connection cycle in respect of the output pair $42_3, 43_3$, and so on. Thus in effect the scanning by the reception beam having the output $42_1, 43_1$ leads the scanning by the reception beam having the output

42₂,43₂ which in turn leads the scanning by the reception beam having the output 42₃,43₃ and so on, even though the scanning by all reception beams takes place simultaneously. Control signal generator 31 is so constructed and synchronized with the transmitter of Figure 3 that each scan by each of the M reception beams results in that beam tracking reflected energy derived from a respective one of the transmitted pulses. To this end generator 31 may comprise a suitably programmed read-only memory provided with a resettable address counter which is clocked by the master clock 7 (as indicated at "C") and is synchronized with the cycling of the transmitter control signal generator 27 via the communication channel 38.

It will be recalled from the description of the transmitter of Figure 3 that the transmitted pulses are modulated or coded in such a way that any two directly successive pulses are coded differently. The set of codes employed is, of course, not infinite and consequently the codes are repeatedly cycled through. The scanning effected by multiplexer 19 is arranged to be such that the reception beam corresponding to each output 42,43 always tracks reflected energy derived from pulses coded in the same way, and the two components of each output 42,43 are coupled to respective filters 44 and 45 which are matched to the relevant code. Thus each pair of filters 44,45 at all times discriminates in favour of the reflected energy being tracked by the corresponding reception beam at the expense of reflected energy derived at least from the transmitted pulses which respectively immediately precede and immediately succeed the pulse from which the energy currently being tracked derives. Relating this to the situation illustrated in Figure 2 it will be appreciated that the filters 44 and 45 situated in the output signal path of reception beam 53 discriminate in favour of reflected energy derived from the volume of space 57 at the expense at least of reflected energy derived from the volumes of space 59 and 61. Energy derived from the volumes of space 60 and 62 will also be discriminated against if at least three different codes are employed. The effect at the outputs of the

filters 44 and 45 is as if the magnitudes of at least some of the sidelobes of the corresponding reception beam have been reduced.

The output of each matched filter 44 is coupled to a corresponding input of a digital adder 46 via a respective delay device 47, and the output of each matched filter 45 is coupled to a
5 corresponding input of a digital adder 48 via a respective delay device 49. Delay device 49_M is shown in dashed lines as it may be omitted, as may delay device 47_M (not shown). The delays produced by delay devices 47₁ and 49₁ are each $(M-1)T$ greater
10 than the delays produced by delay devices 47_M and 49_M (if present), where T is the period of the pulses transmitted by the transmitter of Figure 3, i.e. the period of the control signal fed to the control signal input 28 of switch 25. The delays produced by delay devices 47₂ and 49₂ are each T less than the delays
15 produced by delay devices 47₁ and 49₁, the delays produced by delay devices 47₃ and 49₃ (if present) are each T less than the delays produced by delay devices 47₂ and 49₂, and so on. Adder 46 therefore coherently integrates the I components of the returns resulting from every M successively transmitted pulses, and adder
20 48 similarly integrates the Q components thereof. The resulting integrated returns are then processed, in a manner which may be conventional, in a processing section 50.

The matched filters 44 and 45 may, for example, each take the form of a correlator in which the relevant coded signal has been
25 stored as a reference. Such correlators are commercially available. In an analogue implementation they could, for example, each take the form of a filter, e.g. a surface acoustic wave device, have an appropriate dispersive characteristic.

In addition to controlling the oscillators 5 and 6 and
30 clocking the control signal generator 31, master clock 7 in Figure 4 also controls the clocking of the A/D converters 9 and 10, the multipliers 11, the DFT calculating arrangement 19, the filters 44 and 45, the delay devices 47 and 49, the adders 46 and 48 and the processing in the block 50. In order not to over-complicate the
35 drawing this phase control and clocking is indicated merely by

arrows C. In a particular embodiment the clock rate was 5MHz obtained from the output of a 10MHz master clock 7 by means of a frequency divider-by-two.

5 The synchronization of the receiver(s) to the transmitter over the communication channel 38 may be achieved, for example, in the manner described in a paper "Development of a Multistatic Measurement System" by J.E. Salah and J.E. Morriello in the 1980 IEEE International Radar Conference Proceedings at pages 88-93.

10 Although as described the beam 54 of pulses (Figure 2) transmitted by the aerial 26 of Figure 3 has been assumed to be stationary, this is not necessarily the case. Obviously, if the beam 54 itself scans, the orientation of the reception beams produced by the aerial system 1 of Figure 4 will have to be dynamically adjusted to correspond, i.e. so that these reception
15 beams and the transmitted beam always lies in the same plane. This may be done either by mechanically altering the orientation of the linear array 2 of reception elements 3 in dependence upon the contents of the address counter included in the control signal generator 31, or by augmenting the linear array 2 by further linear
20 arrays and corresponding components 4,9,10,11 and 14 so that a two-dimensional array is formed, the reception beams of such an arrangement being scannable in two orthogonal directions, and hence in directions in between, by suitably upgrading the multiplexer 19.

25 Obviously it is not essential that the receiver aerial system takes the form of a multiple-beam phased array; the various reception beams may, for example, be obtained by means of respective, completely independent, steerable aerial system components.

30 From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of radar systems and component parts thereof and which may be used instead of or in addition to features already described herein. Although claims have been formulated in this
35 application to particular combinations of features, it should be

understood that the scope of the disclosure of the present application also includes any novel feature or any novel combination of features disclosed herein either explicitly or implicitly or any generalisation thereof, whether or not it relates to the same invention as presently claimed in any claim and whether or not it mitigates any or all of the same technical problems as does the present invention. The applicants hereby give notice that new claims may be formulated to such features and/or combinations of such features during the prosecution of the present application or of any further application derived therefrom.

(25 26 27)✓

CLAIM(S)

1. A radar system which comprises a radar transmitter and a radar receiver in spaced relationship, the transmitter comprising transmitter means for transmitting a beam of pulsed radio energy and the receiver comprising an aerial system for receiving said energy after reflection by a target, the transmitter means being arranged to transmit the pulses of radio energy at rate which is sufficient to result in reflected energy derived from a plurality of said pulses being received by said aerial system simultaneously, said aerial system having a directional characteristic such that a plurality of reception beams, each having a respective output signal path, are defined, and the receiver including scanner means for repeatedly scanning at least two of said reception beams along the transmitted beam at the same time so as to track reflected energy derived from respective ones of the transmitted pulses, said respective ones of the transmitted pulses being, for each scan, pulses which are transmitted in direct succession by the transmitter, characterised in that said transmitter means is arranged to code each transmitted pulse in such manner that at least any two pulses which are transmitted in direct succession are coded differently from each other, and in that the receiver includes a respective filter in the output signal path of each scanned reception beam for discriminating, on the basis of the coding of the pulses, in favour of signals resulting from the reception of reflected energy currently being tracked by the corresponding reception beam at the expense at least of any signals resulting from the reception of reflected energy derived from those transmitted pulses which respectively directly precede and directly succeed the transmitted pulse from which the reflected energy currently being tracked is derived.

2. A system as claimed in Claim 1, including delay means for introducing relative delays into the output signal paths of the scanned reception beams so that signals resulting from the reception of energy currently being tracked by the respective beams, which reception results from reflection by the same target,

will coincide in time at the outputs of the various said output signal paths, and means for combining the output signals of the various said output signal paths.

5 3. A radar receiver for use in a system as claimed in any preceding claim, comprising an aerial system having a directional characteristic such that a plurality of reception beams, each having a respective output signal path, are defined, scanner means for causing at least two of said reception beams to repeatedly scan a given region at the same time but in a staggered manner, and a
10 respective filter included in the output signal path of each scanned reception beam for discriminating in favour of signals coded in a particular way at the expense of signals coded in such a way that they are discriminated in favour of by the filter(s) corresponding to the immediately preceding and immediately
15 succeeding scanned reception beams.

4. A radar system substantially as described herein with reference to the drawings.

5. A radar receiver substantially as described herein with reference to Figure 4 of the drawings.

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Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

-16-

Application number

9027832

Relevant Technical fields

i) UK Cl (Edition)
K HYD [DRPZ]

ii) Int Cl (Edition 5)
G01S

Search Examiner

King

Databases (see over)

(i) UK Patent Office

(ii)

Online databases: WPI, INSPEC

Date of Search

25 April 1991

Documents considered relevant following a search in respect of claims

1-5

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	International Conference Radar 87 (Conf. Publication No 281) London 19-21 October 1987, page 12-16 "Description of an experimental bistatic radar system". Soame, T.A., Gould, D.M.	1
A	IEE PROC-F, Communications, Radar and Signal Processing: Vol 133, Part F, No 7, December 1986, pages 587/595 "Survey of bistatic and multistatic radar". Haule	1

SF2(p)

Category	Identity of document and relevant passages	Relevant to claim(s)

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